

## CHAPTER 33

## JACK PINE TYPE

**TYPE DESCRIPTION****A. Stand Composition**

More than 50 percent pine with **jack pine** (*Pinus banksiana*) predominant.

**B. Associated Species**

Common Associates: red pine, white pine, scrub oaks, aspen, white birch

Occasional Associates: red maple, black cherry, balsam fir, white spruce

**C. Soil Preference**

Best growth occurs on well-drained loamy sands where the midsummer water table is 4 to 6 feet below the soil surface. Jack pine will persist on very dry sandy or gravelly soils where other species can scarcely survive.

**D. Range of Habitat Types**

In northern Wisconsin the jack pine and jack pine-scrub oak types are common on QAE, QA, AQT, QGCe, AQV, QV, and QAp habitat types with minor occurrence on PAm and PMV (Kotar et al., 1988). The potential for growing large diameter, high quality jack pine is good to very good on QAE, QA, AQT, and QGCe; very good to excellent, with moderate competition intensity, on AQV, QV, and QAp; and excellent, despite strong competition intensity, on PAm and PMV. On sandy soils in areas south of the floristic tension zone, jack pine often occurs with scrub oak.

**SILVICAL CHARACTERISTICS\***

Species	Jack pine
Pollination	In the Lake States, strobili become visible in late May and pollination occurs shortly thereafter.
Cones Mature	Cones are 4 to 6 mm long by the end of the first season and 35 to 40 mm long by the following year. Moisture content of cones and viability of seed decrease as cones age, with cone color changing from green to brown to gray. Some cones fall to the ground each year but some cones remain on the tree for 20 years or longer.
Seed Dispersal	<p>Cones are serotinous over most of geographic range, and may remain closed for 10 to 25 years until opened by fire or logging. Some cones open during dry weather when the temperature is at least 80°F. Up to 50 percent of cones may open on the sunny part of the crown. Cones may also open during the winter when the temperature is extremely low.</p> <p>In the Lake States seed may be disseminated during any season. The range of dispersal is about two tree-heights from the base of the parent tree. Birds and rodents can consume up to 75 percent of dispersed seed.</p>

Good Seed Years	Every 3 to 4 years with light crops in most intervening years. Crop failures are rare. Seed production begins at 5 to 10 years of age in open growth, and at 10 to 25 years of age in stands. Best seed production is from trees between 40 and 50 years old. A well-stocked stand can produce 13 pounds of seed per acre with seed numbers averaging 131,000 seeds per pound.
Germination	Under favorable conditions seed usually germinates within 15 to 60 days. Highest seedling survival rates are observed for seeds that fall in April, May, June, and November. Mineral soil, light partial shade and high water table favor seedling establishment. Germination rates are reduced if seed is exposed to direct sunlight more than four hours per day. Jack pine seedlings are most abundant in the understory when light intensity is 11 to 30 percent of full sunlight, but height growth is greatest in light intensities of 52 percent or more.
Seed Viability	Seeds retained in cones maintain high viability for at least 5 years and sometimes for more than 15 years. In cones exposed to fire, seeds are uninjured by temperatures that do not cause actual cone ignition (e.g., 60 sec at 700°F, 30 sec at 900°F, 2 sec at 1200°F).
Seedling Development	During the first season the root system penetrates to a depth of 5 to 10 inches. On typical sandy soils, seedlings are 3 to 4 inches tall, and roots are 11 to 13 inches deep with a lateral spread of 18 to 24 inches by the end of the second season. By the fourth year wild seedlings are usually 1 to 3 feet in height. Numerous factors hinder seedling survival: drought, high soil surface temperatures, prolonged flooding, insects, diseases, deer browse, ice damage, and nipping and girdling by snowshoe hares.
Growth	<p>In well-stocked stands, jack pine is short to medium tall, slender, with a narrow open crown covering 30 to 45 percent of stem. In open growth, it tends to be stocky, with poor form and a wide spreading crown.</p> <p>During the first 20 years, jack pine is one of the fastest growing conifers, being second only to tamarack. Seedlings reach breast height in 5 to 8 years. On average sites, growth averages about one foot a year to 50 years of age.</p> <p>On the best sites stands begin to break down after 80 to 100 years; on poor sites, after 60 years. However, vigorous trees, 185 years old, 20 inches in diameter and 100 feet tall, are known in Minnesota. Most older jack pine stands in the Lake States were established following fires, but many younger stands have developed from advance regeneration before the overstory was clearcut.</p>
Shade Tolerance	Jack pine is one of the more intolerant trees in its native range. It is ranked as less tolerant than red pine. Jack pine is a pioneer species on burns and exposed sandy sites. It tends to be succeeded by more tolerant species if regular catastrophic disturbances, especially fire, are eliminated.
Major Pests	<p>Stands are subject to <b>pine bark beetle</b> (<i>Ips pini</i>) attack from early May to the end of August. Logging can be conducted during this period if slash is lopped low to the ground. Beetles emerge from logs in 30-35 days.</p> <p>To limit <b>jack pine budworm</b> (<i>Choristoneura pinus</i>) infestation, avoid unthrifty, stagnant and overmature stands. In case of budworm outbreak, remove mature stands adjacent to young stands to avoid damage to the younger stand.</p>

To prevent **pine root weevil** (*Hylobius rhizophagus*) infestation, avoid planting old farmed-out fields to jack pine. Don't mix red pine and jack pine in plantations.

Jack Pine Pest Management Guidelines are included at the end of this chapter.

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\* Mainly from Fowells (1965).

## **MANAGEMENT ALTERNATIVES**

The management objective should be identified within an ecosystem framework, giving consideration to a variety of objectives within the local and regional landscape. The habitat type is the preferred indicator of site potential. Depending on the habitat type, possible timber management alternatives range from managing for fiber rotations to managing for sawtimber. The jack pine type should be retained wherever possible by regenerating harvested stands. Development of compositional and structural diversity is encouraged.

## **SILVICULTURAL SYSTEM**

Even-age management will be applied with thinnings based on site quality. Structural variety should be encouraged.

## **MANAGEMENT RECOMMENDATIONS**

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### **A. Seedling/Sapling Stands (0-5" DBH)**

Give full release to jack pine for maximum growth. Sapling stands with a site index of 50 or less (see Figure 33.1) and stocked in excess of 2000 stems per acre should be thinned to 800 to 1200 stems. Higher quality stands will thin themselves through natural suppression.

### **B. Pole and Small Sawtimber Stands (5-9" and 9-15" DBH, respectively)**

Key to recommendations:

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- |   |   |
|---|---|
| 1. Relatively pure jack pine stands             | If it is at least 12 to 15 years before the rotation year, reduce basal area to 80 to 100 square feet when stand attains a density of 130 square feet. Normally thinnings should be limited to dense plantations, or stands on higher quality sites.<br><br>To regenerate the stand at rotation age, refer to Table 33.1 for regeneration alternatives. |
| 1. Mixed stands                                 | <b>2</b>  |
| 2. Red pine and white pine mixed with jack pine | If stocking of red pine or white pine is at least 400 stems of seedlings and saplings, or 50 square feet of poles and sawtimber, per acre, then a viable alternative may be to manage for red pine or white pine by favoring them in subsequent thinnings. The presence of blister rust and tip weevil may influence the decision on                    |

white pine management options. Always give full release to red pine.

If stocking of red pine or white pine is inadequate, manage for jack pine as described in Table 33.1. Red and white pine offer the opportunity to increase compositional and structural variety in these situations.

2. Other mixtures

3

3. Fir-spruce mixed with jack pine

Depending on habitat type and current stand composition, three options are possible:

- a) Manage for jack pine. Clearcut at rotation age, removing a fir-spruce seed source. Scatter and disc slash to eliminate advance fir-spruce regeneration and encourage jack pine seeding.

**OR**

- b) Manage for fir-spruce by creating a shelterwood. Reduce stand stocking level to 70-80 square feet, favoring fir-spruce, approximately ten years before anticipated overstory removed.

**OR**

- c) Clearcut and convert to red or white pine through site preparation and planting.

3. Hardwood mixture

4

4. Aspen mixed with jack pine

Depending on habitat type and current stand composition, three options are possible:

- a) If aspen stocking is light, individual trees can be eliminated by basal treatment prior to rotation cut. Apply regeneration alternatives as described in Table 33.1.

**OR**

- b) Clearcut mixture, apply methods to encourage jack pine regeneration, and accept whatever increase in aspen stocking occurs in the next rotation.

**OR**

- c) Clearcut and convert to red or white pine through site preparation and planting.

4. Oak mixed with jack pine

Depending on the habitat type and current stand composition, two options are possible:

- a) Clearcut and regenerate to jack pine following one of the methods described in Table 33.1. Mixtures of oak can be encouraged to promote diversity and wildlife benefits.

**OR**

- b) Clearcut and convert to red or white pine through site preparation and planting.
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C. Regeneration

Regeneration alternatives for jack pine are listed in Table 33.1. Additional comments pertaining to these methods are listed below.

1. Direct seeding of jack pine should be limited to areas of low competition. The following criteria should be applied when direct seeding:
  - a) Do not use direct seeding on high quality sites (e.g., PMV and PAm habitat types) where plant competition will limit desired results.
  - b) Prepare site in a manner so as to obtain a large portion of exposed mineral soil.
  - c) Do not direct seed rough sites where seed will be covered or washed away.
  - d) Disking or patch scarification, if used, should precede seeding by an adequate length of time to allow leveling or stabilization of mineral soil.
  - e) Seeding density should be approximately 20,000 to 30,000 (average 131,000 seed/lb.) treated, viable seeds per acre. Prorate if seeding only a portion of each acre.
  - f) Best opportunity and results are usually associated with early spring seeding.
  - g) Allow two growing seasons to pass before judging success. Then re-seed if necessary and if good seed bed remains.
2. Plantations should be liquidated with an early rotation cut if they are inferior to natural stands growing under similar conditions.
3. Potential growth gains after thinning must be weighed against the post-sale mortality that almost always accompanies a thinning.
4. Do not leave red pine sentinels except for aesthetic or ecological purposes.
5. If pre-sale scarification is undertaken, avoid piling dirt against trees to minimize felling problems.
6. At least 15 cones per millacre should be present to get successful regeneration from cone-bearing slash.

7. The following stand conditions must be present prior to prescribed burning:
  - a) Normally at least 100 square feet of basal area is necessary to provide adequate slash to fuel a good prescribed fire.
  - b) The stand should be a minimum of 25 to 30 acres to justify costs incurred in prescribed burning.
  - c) If seed trees are selected as post-sale seed source, an adequate number of closed serotinous cones must be present prior to the burn.
  - d) Conducive weather conditions must also be present.
8. Foresters interested in conducting a controlled burn should contact the "Prescribed Fire Specialists" from both the Management and Marketing and the Protection and Reforestation Sections.

## **REFERENCES**

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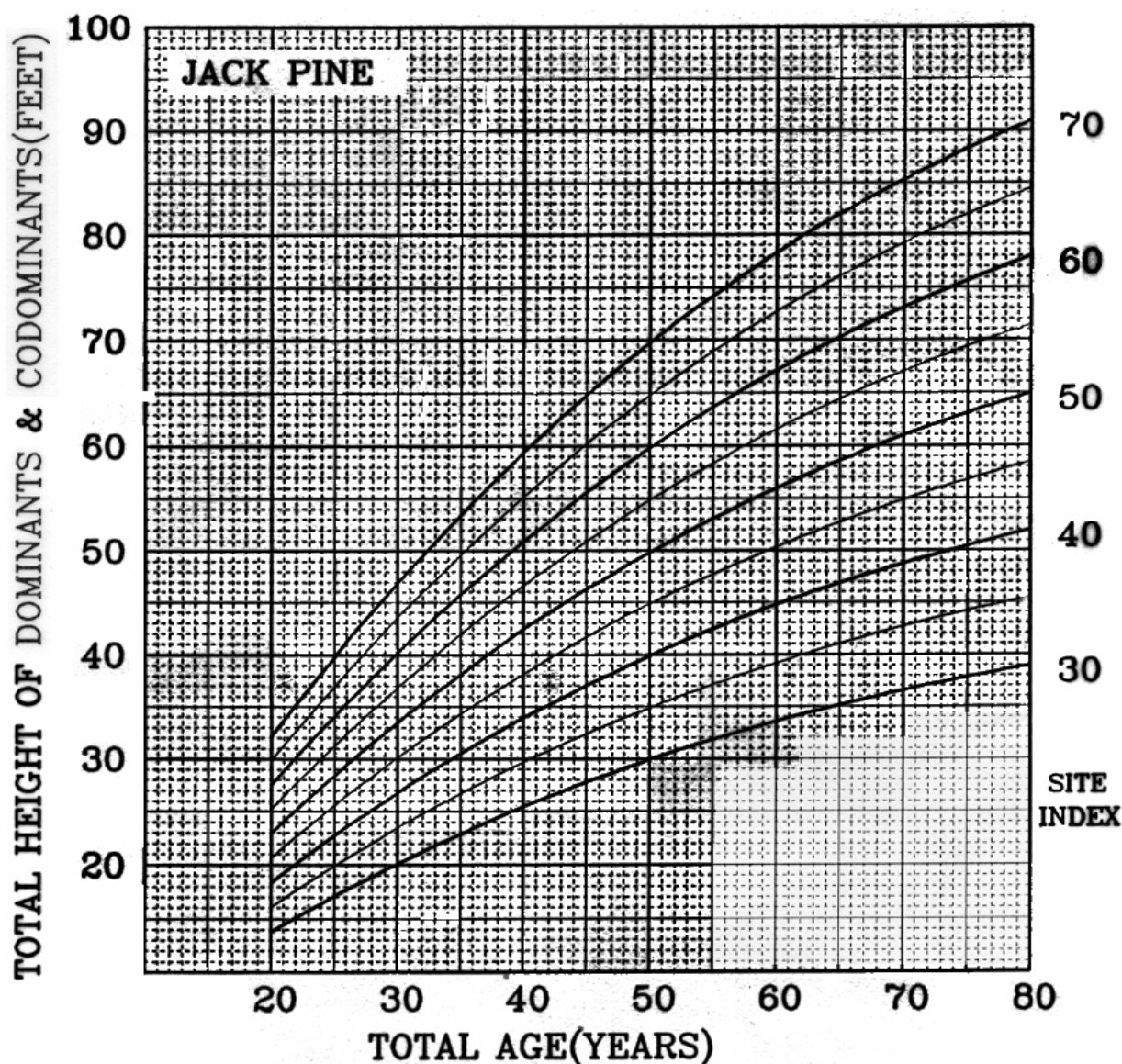
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### **Pest Control**

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Figure 33.1 Site index curves for jack pine in the Lake States (Carmean et al., 1989).

Site index	70	60	50	40	30
Rotation age (years)	70	60	55	50	45 +



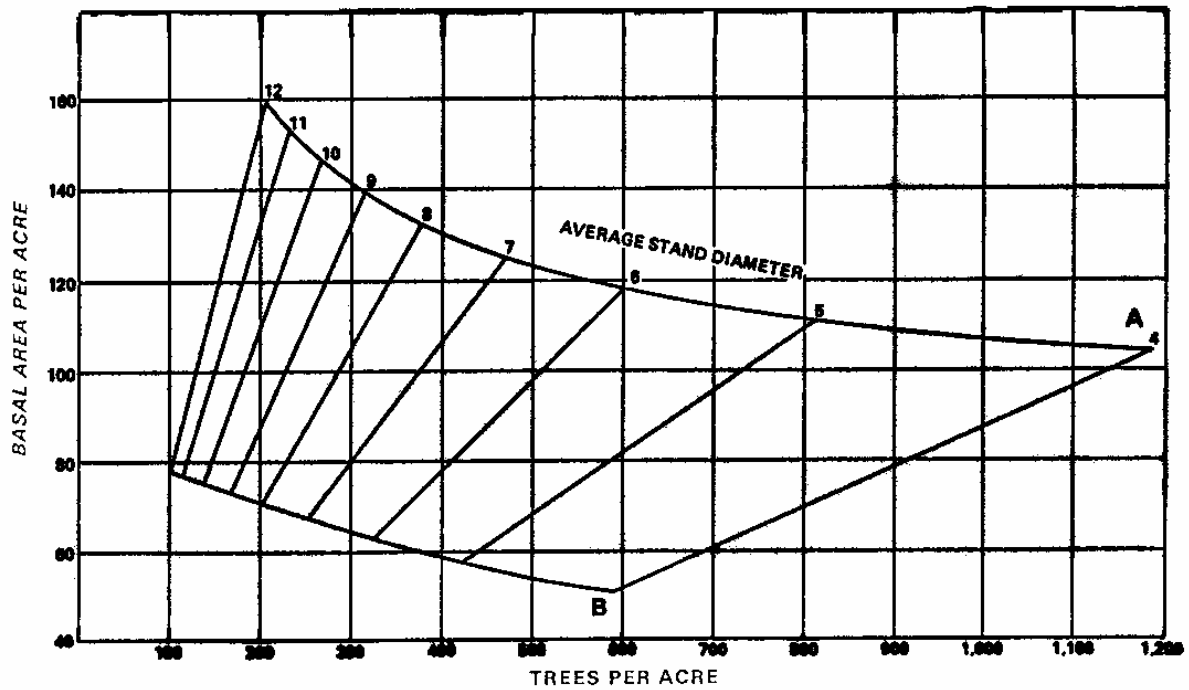
Jack pine (Gevorkiantz 1956c, derived from Wackerman *et al.* 1929, and from Eyre and LeBarron 1944)  
 Lake States  
 Number of plots and number of dominant and codominant trees not given  
 Total height and total age, anamorphic, equation not given  
 Convert d.b.h. age to total age by adding years according to site index (BH = 0.0):

SI:	30	40	50	60	70	80	90
Years:	9	8	7	6	5	4	4

	$b_1$	$b_2$	$b_3$	$b_4$	$b_5$	$R^2$	SE	Maximum difference
H	1.6330	1.0000	-0.0223	1.2419	0.0000	0.99	0.50	1.1
SI	0.6124	1.0000	-0.0223	-1.2419	0.0000	0.99	0.50	1.1



Figure 33.2      Stocking chart for jack pine stands (Benzie, 1977).



Recommended upper limit (A-curve) is based on stand tables from Eyre and LeBarron (1944) and adjusted to approximately 85 percent stocking for pole timber and 100 percent stocking for sawtimber stands. Minimum stocking (B-curve) is based on crown width for open-grown trees.

**Table 33.1    Regeneration alternatives for jack pine.**

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1.    Shelterwood

Reduce stocking level to 50 to 60 square feet to create shelterwood and encourage advance regeneration five years prior to rotation cut. The thinning operation will provide some scarification. Remove overstory when advance regeneration becomes well-established. Apply only if an adequate number of non-serotinous cones is present as seed source.

2.    Scarify and Scatter Slash

Pre-scarify stand with blade to expose mineral soil within one year prior to rotation cut. If disc is used, allow additional time for mineral soil to stabilize before clear cutting. Slash should be lopped and scattered for good seeding results. Apply only if adequate number of closed cones are present prior to sale.

3.    Clearcut and Scatter Slash

Clearcut, scatter slash, and disc if necessary to regenerate from closed cones present in slash.

4.    Direct Seeding

Before direct seeding, prepare the seedbed by prescribed fire or by mechanically exposing at least 50 percent mineral soil. Direct seeding can be conducted either by airplane, broadcast seeder or controlled seeding such as in a prepared furrow.

5.    Seed Tree and Control Burn

Select 12 to 25 phenologically desirable seed trees per acre with serotinous cones. Remove the remaining jack pine and control burn the slash. Depend on the seed trees for regeneration. Seed trees may be salvaged for posts, poles or sawtimber after regeneration develops.

6.    Plant Jack Pine

Prepare the site and plant jack pine seedlings where maintenance of type is essential.

7.    Conversion

Depending on opportunities and objectives, may convert to other associated species or develop a more intimately mixed stand in terms of species composition and structural development.

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## PEST MANAGEMENT GUIDELINES FOR JACK PINE WISCONSIN DNR, FOREST PEST MANAGEMENT

HAZARD	LOSS OR DAMAGE	PREVENTION, MINIMIZING LOSSES AND CONTROL ALTERNATIVES	REFERENCES
Jack Pine Budworm	<p>Periodic outbreaks of spring and early summer defoliation. One heavy defoliation causes 10-15% top kill and 5% mortality. Two heavy defoliations cause 45-50% top kill and 20-25% mortality. Poorer sites suffer heavier losses for a given level of defoliation.</p> <p>STAND CONDITIONS THAT CONTRIBUTE TO OUTBREAK:</p> <ol style="list-style-type: none"> <li>1. Open-grown stands of saplings - sawtimer (wolf trees) with abundant staminate cones may initiate outbreaks.</li> <li>2. Overstocked stands with suppressed trees with abundant staminate cones may initiate outbreaks.</li> <li>3. Overmature, low-vigor stands may initiate outbreaks.</li> <li>4. Large contiguous blocks of single age that may become susceptible to budworm all at one time.</li> </ol>	<p>Merchantable stands that are heavily defoliated should be considered for immediate harvest. In these cuts, irregular boundaries and aesthetic leave strips should be avoided or minimized.</p> <p>Aerial insecticide applications are seldom feasible.</p> <p>MINIMIZE VOLUME OF STAMINATE CONES BY MAINTAINING CORRECTLY STOCKED STANDS:</p> <ol style="list-style-type: none"> <li>1. Maintain stocking at 70-100 sq. ft./acre; stands under 60 square feet should be harvested.</li> <li>2. Thin or harvest.</li> <li>3. Harvest at rotation age. Guideline: Rotation age=SI minus 5 years.</li> <li>4. Promote age class diversity through well timed harvests.</li> </ol>	<p>Wisconsin Woodlands: Identifying and Managing Pine Pests in Wisconsin. H. Goulding, et al. 1988. Univ. Wis. Ext. G3428.</p>
Pine Tussock Moth	<p>Periodic outbreaks of spring and early summer defoliation. One heavy defoliation causes an average of 50% top kill and 25% tree mortality with pockets of complete mortality. Two heavy defoliations cause nearly total loss of stand. Stand age and stocking levels have no apparent effect on defoliation.</p>	<p>ALTERNATIVES:</p> <ol style="list-style-type: none"> <li>1. Merchantable stands that are heavily defoliated should be considered for immediate harvest.</li> <li>2. Monitor population and apply insecticide to stands that are threatened with heavy defoliation.</li> <li>3. Promote species diversity by establishing small jack pine stands and by breaking up large stands by converting to red pine. Jack pine should cover no more than 40% of a large area (township).</li> </ol>	<p>Wisconsin Woodlands: Identifying and Managing Pine Pests in Wisconsin. H. Goulding, et al. 1988. Univ. Wis. Ext. G3428.</p>

## SPECIAL HAZARD ZONE

Pine Tussock  
Moth/Jack Pine  
Budworm T44N,  
R10-12W;  
T45N, R9-11W;  
T46N, R9-10W.  
(Parts of Douglas  
and Bayfield  
Counties)

Repeated major outbreaks.  
Outbreaks begin in small pockets  
of less than 1,000 acres and spread  
to 40,000-60,000 acres in one or  
two more years.

### SILVICULTURAL PRACTICES FOR SPECIAL HAZARD ZONE:

1. Rotation Age: If site index is 55 or less, harvest at age 40-45; if site index is 60 or more, harvest at SI minus 5 years.
2. Stand Size: Contiguous stands of jack pine more than a section in size should be discouraged.
3. Species Mix: Reduce jack pine to 30% or less of the cover type. Convert to alternate species.

### POPULATION MANAGEMENT:

Monitor population and treat small, first-year tussock moth outbreaks with insecticide to prevent spread.

Redheaded Jack  
Pine Sawfly

Spring and possible summer  
defoliation of saplings resulting in  
growth loss and possible tree  
mortality.

Accept some defoliation and possible tree mortality.  
Spray with insecticide.

Guide to Insect Injury of  
Conifers in The Lake States.  
USFS. Agr. Handbook No.  
501.

Jack Pine Sawfly

Spring defoliation of sapling to  
sawlog sized trees and subsequent  
growth loss. Occasional mortality  
in overmature and other low-vigor  
stands.

Promote stand vigor.  
Spray with insecticide.  
Harvest merchantable material.

Guide to Insect Injury of  
Conifers in the Lake States.  
USFS. Agr. Handbook No.  
501.

Pine Tortoise  
Scale

Sap sucking on twigs causes loss of  
vigor, occasional tree mortality.

Promote early stand closure.  
Spray with insecticide (usually not economically feasible).

Wisconsin Woodlands:  
Identifying and Managing Pine  
Pests in Wisconsin. H.  
Goulding, et al. 1988. Univ.  
Wis. Ext. G3428.

Pine Engraver Beetle (Bark Beetles)	Tunneling in inner bark causes mortality in sapling to sawlog sized trees, singly or in pockets. In the spring, beetles build up in any available diseased or storm-damaged pine stems or logging slash. They emerge in summer and attack any surrounding moisture-stressed pines. Mortality is usually limited to few trees in normal weather but may cover several acres in dry summers. Spring and summer thinning and logging operations may provide material for beetle population build-up, especially during dry years.	<p>Maintain stand vigor by avoiding overstocking and by avoiding overmature stands.</p> <p>If low vigor is due to drought or defoliation, consider presalvage harvest.</p> <p>Storm-damaged material should be harvested or monitored for build-up of bark beetle population.</p> <p>Thinning is best done between September and March.</p> <p>If summer thinning is necessary:</p> <ol style="list-style-type: none"> <li>1. Tops should be utilized down to 2-inch diameter.</li> <li>2. Leave branches attached to stem wood to speed drying.</li> <li>3. Remove cut products from stand within 3 weeks of cutting.</li> <li>4. Beetle population in slash should be monitored; if dangerous level occurs, mangle bark by driving over it with a tracked vehicle or chip slash.</li> </ol> <p>If a pocket of trees are attacked, a well-timed emergency harvest of attacked and adjacent low-vigor trees during the growing season will eliminate local population.</p>	<p>Guide to Insect Injury of Conifers in the Lake States. USFS. Agr. Handbook No. 501.</p> <p>Wisconsin Woodlands: Identifying and Managing Pine Pests in Wisconsin. H. Goulding, et al. 1988. Univ. Wis. Ext. G3428.</p>
Pine Root Tip Weevil and Root Collar Weevil	Tunneling under bark of root collar and root feeding may cause growth loss, branch flagging and tree mortality.	<p>MANAGEMENT ALTERNATIVES:</p> <ol style="list-style-type: none"> <li>1. Avoid establishing jack pine stand near scotch pine or remove scotch pine.</li> <li>2. Avoid establishing jack pine on extremely nitrogen-deficient soil.</li> <li>3. Wait 3 years before establishing jack pine on former scotch pine sites.</li> <li>4. Harvest merchantable material when flagging appears.</li> </ol>	<p>Wisconsin Woodlands: Identifying and Managing Pine Pests in Wisconsin. H. Goulding, et al. 1988. Univ. Wis. Ext. G3428.</p>
Eastern Gall Rust	Stem galls may cause mortality of seedlings and cull or stem breakage in older trees.	<p>Remove worst stems when thinning.</p> <p>Do not plant infected nursery stock.</p> <p>Cull stock with galls present on the stems (most often at ground line).</p>	<p>How to Identify and Control Stem Rusts of Jack Pine. K. Robbins. 1981. USDA-Forest Service.</p>